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RADIOACTIVE WASTE DISPOSAL OPERATIONS

ANNUAL REPORT FOR 1954

A. F. Rupp and E. J. Witkowski

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RADIOACTIVE WASTE DISPOSAL OPERATIONS – ANNUAL REPORT FOR 1954

INTRODUCTION

This report covers the operation of the main waste disposal facilities, under the jurisdiction of the Operations Division, servicing the laboratories and operating buildings located in the Bethel Valley area. These facilities include the hot chemical and metal waste systems, the process waste system (frequently called the semihot waste system) (see Fig. 1) and the radioactive gas disposal system (see Fig. 2), which utilizes the 250-ft stack located in the Radioisotope Area. The report does not cover the disposal of cooling water from the LITR, gases from the Hot Pilot Plant and the Graphite Reactor buildings, wastes discharged to White Oak Creek from the Homogeneous Reactor, and the disposal of solid wastes at the Burial Ground.

OPERATING COSTS

The operating cost of $167,593 for calendar year 1954 represents a saving of $32,111 over the previous year. A decrease in the overhead charges accounted for 19.6% of the total saving; the main portion of the balance can be credited to a reduction in the use of manpower, material, and steam resulting from the shutdown of the waste evaporator which was made possible by the installation of the waste transfer line between the tank farm and the waste pits. A comparison of costs for the last five calendar years follows.

Year	Cost (Including Overhead)
1954	$167,593
1953	199,704
1952	208,331
1951	288,465
1950	274,119

HOT CHEMICAL WASTE SYSTEM

Waste Volume

A total of 1,669,000 gal of waste was received into the hot chemical waste system this year. This volume represents a reduction of 26% over the average of the four previous years. The shutdown of the Hot Pilot Plant operations during a large portion of the year accounted for most of the reduction in volume.

Volume Control

Close monitoring of the various operating areas by use of the monitoring tanks contributed substantially to the control of waste volumes, although the work continued to be difficult in two areas where monitoring tanks are needed: one was the Metal Recovery Building, and the other was the Graphite Reactor and Hot Pilot Plant. Both these areas are now connected to a common monitoring tank. The project to install a monitoring tank for the exclusive use of the Graphite Reactor Building was postponed in order that a single installation may be built to service the existing building as well as the LITR and the future Research Reactor Building.

One significant change was made in the monitoring system this year. The concrete tanks W-1 and W-2, which serviced the Hot Pilot Plant and the Graphite Reactor Building, were replaced with a single 4000-gal, stainless steel tank after it was found that one concrete tank was leaking and that the other was in poor condition.

Neutralization

Because of the increase in the amount of HCl used in some of the Laboratory's processes in the last several years, questions arose concerning the advisability of neutralizing all wastes entering the monitoring tanks in order to protect the tanks against excessive corrosion. A test was made by installing corrosion coupons inside the tanks, and it was demonstrated that the corrosion over a period of six months was negligible; therefore, it was decided to continue with the present method of waste collection without the installation of expensive neutralizing equipment.

New Pipeline

The most important change made in the hot-waste disposal operation during the last several years was the installation of a 1½-mile pipeline and pumping station between the tank farm and the waste disposal pit area. Before the pipeline was put into operation in June of this year, all hot wastes were reduced in volume by evaporation and the concentrate was hauled by truck trailer to the waste disposal pits. The operation was expensive and hazardous because of radiation exposure of operating personnel and the possibility of contamination of roads. Now, the radioactive wastes are temporarily stored in the tank farm until some radioactive decay takes place; then they are pumped directly to the pits through the new pipeline. Operation of the evaporator was discontinued, and the equipment was put in standby condition.

Excavation of New Waste Pit

By shutting down the waste evaporator, the rate of transfer of waste to the 1,000,000-gal pit was increased by a factor of about 15. It became apparent within several weeks that the seepage rate into the soil surrounding this pit was too low to keep up with the Laboratory's waste production rate and the normal rainfall into the pit. To increase the pit disposal capacity, excavation was started on a second 1,000,000-gal pit in the vicinity of the first one. It is expected that the two pits will be adequate for the disposal of all the Laboratory's hot wastes for the next several years. Completion of the work on the second pit is expected in January 1955 (see Fig. 3).

Nonradioactive Chemical Wastes

The waste pits were also used this year for the disposal of 87,000 gal of nonradioactive concentrated $Al(NO_3)_3$ and NH_4NO_3 wastes. These wastes were hauled by truck trailer directly from the operating buildings. In the transportation of these wastes, the tank of the converted gasoline tank trailer was corroded through by acidic wastes which had been insufficiently neutralized. The trailer was taken out of service, and two AEC surplus gasoline tank trailers were obtained, one to be held as a spare.

After the first tank trailer was taken out of service, an attempt was made to transfer the nonradioactive wastes through the pipeline. This operation ran into difficulty when the pump became gas-bound with ammonia caused by decomposition of NH_4NO_3.

Other Equipment Changes

The piping at tank W-6 was altered to permit the Hot Pilot Plant to discharge its waste directly into this tank and to allow direct pumping of the same waste from W-6 to the waste pits. These changes were made in preparation for handling Thorex wastes, some of which are expected to be more active than any other wastes handled by the system thus far. It will be possible to store them, for decay, for a much longer period of time than usual without mixing them with other less active Laboratory wastes.

Besides the piping alterations at tank W-6, sampling equipment was installed on all three of the hot chemical waste storage tanks, W-5, W-6, and W-8. Sampling for checking pH of solutions contained in these tanks was previously done by dipping in a bottle suspended on a string; this method is too hazardous for use with the Thorex wastes.

A major equipment change planned for the year 1955 is the replacement of the above-ground, black iron, main transfer line system. The radiation background at the tank farm and Metal Recovery Building has at times reached undesirable levels during the last several years because of these lines. With the more active wastes expected in the future, it is believed that the radiation background in some of the operating areas around the tank farm would become too high for safe operation unless the system is changed. The old lines and jets will be replaced by a single pump and manifold arrangement with one line running to each tank; all lines, valves, and other equipment will be made of stainless steel. By adjusting the valve settings, it will be possible to use each line for either suction or discharge, and to pump solutions in either direction between any two tanks.

METAL WASTE SYSTEM

The metal waste collection and storage facilities continued to be adequate after a large portion of the uranium had been removed this year from the tanks by the metal recovery program. The only change made was the disconnection of the monitoring tank WC-8, located behind the Solvent Column Pilot Plant (Building 3503), so that the tank could be used for storage of thorium waste.

PROCESS WASTE SYSTEM

Activity to White Oak Creek

A total of 254 curies of beta activity was discharged to White Oak Creek. This discharge is 59% of that of 1953 and 79% of the average over the four previous years. The decrease may be accounted for by a general decrease in the number of accidental spills experienced this year.

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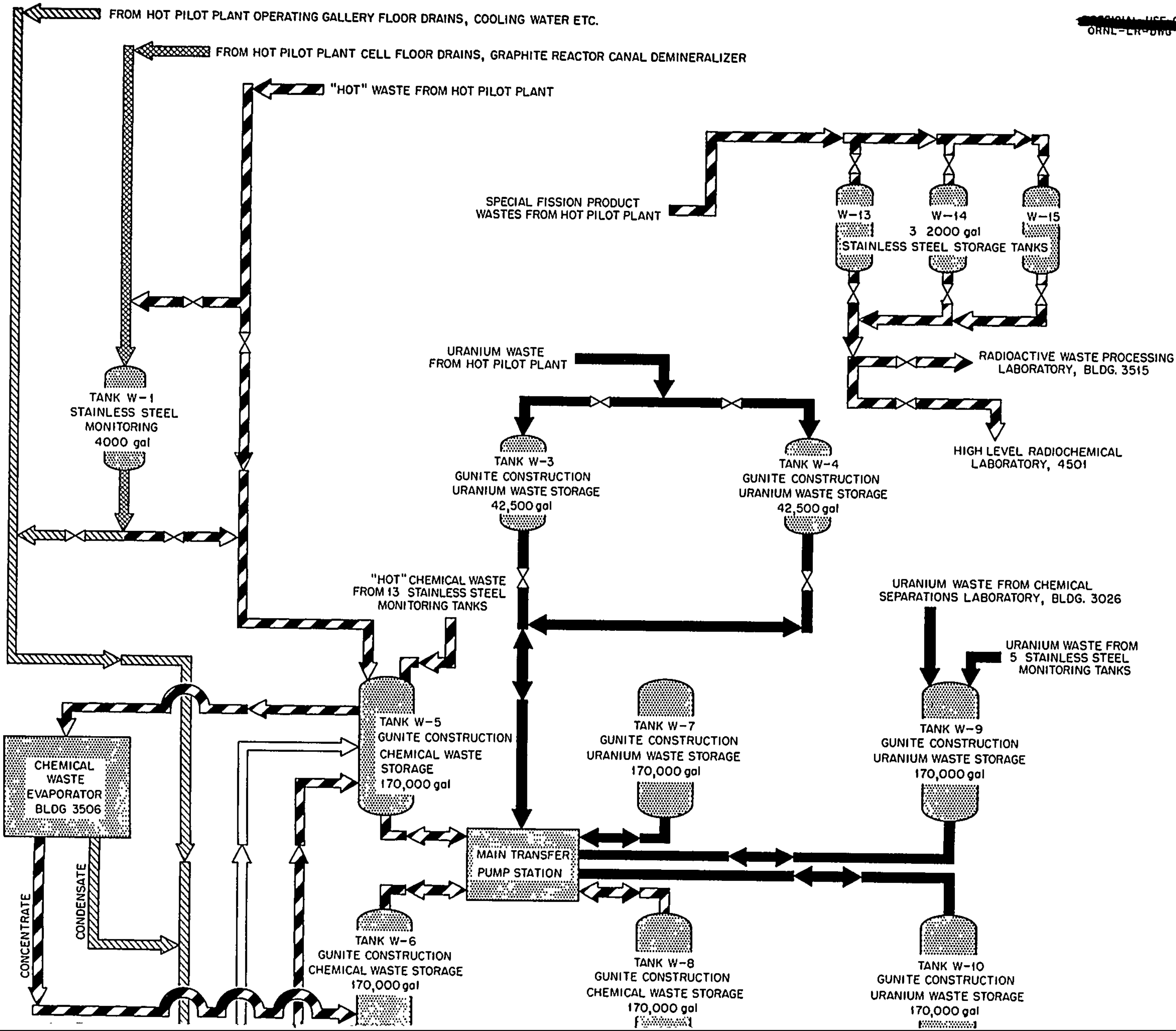


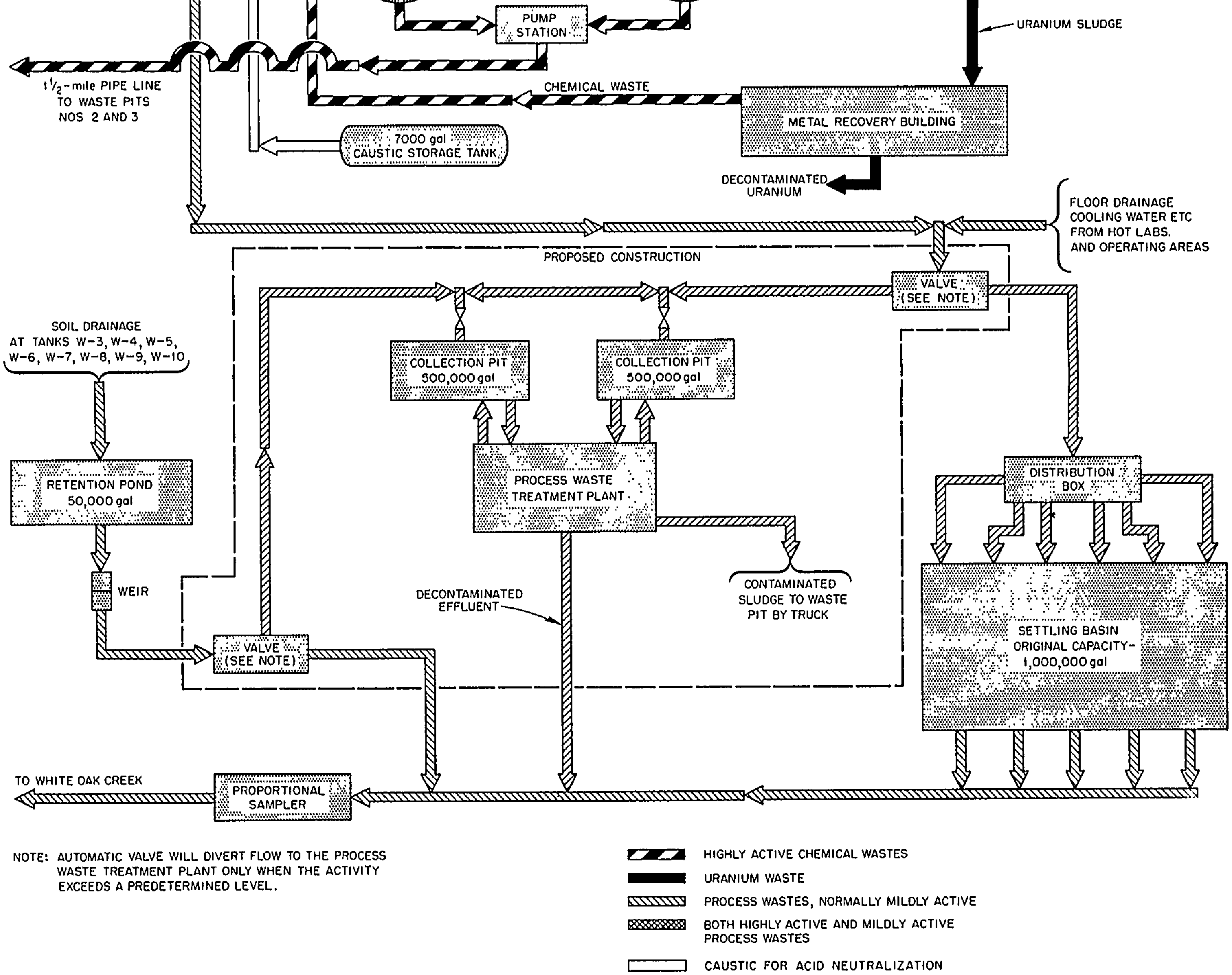
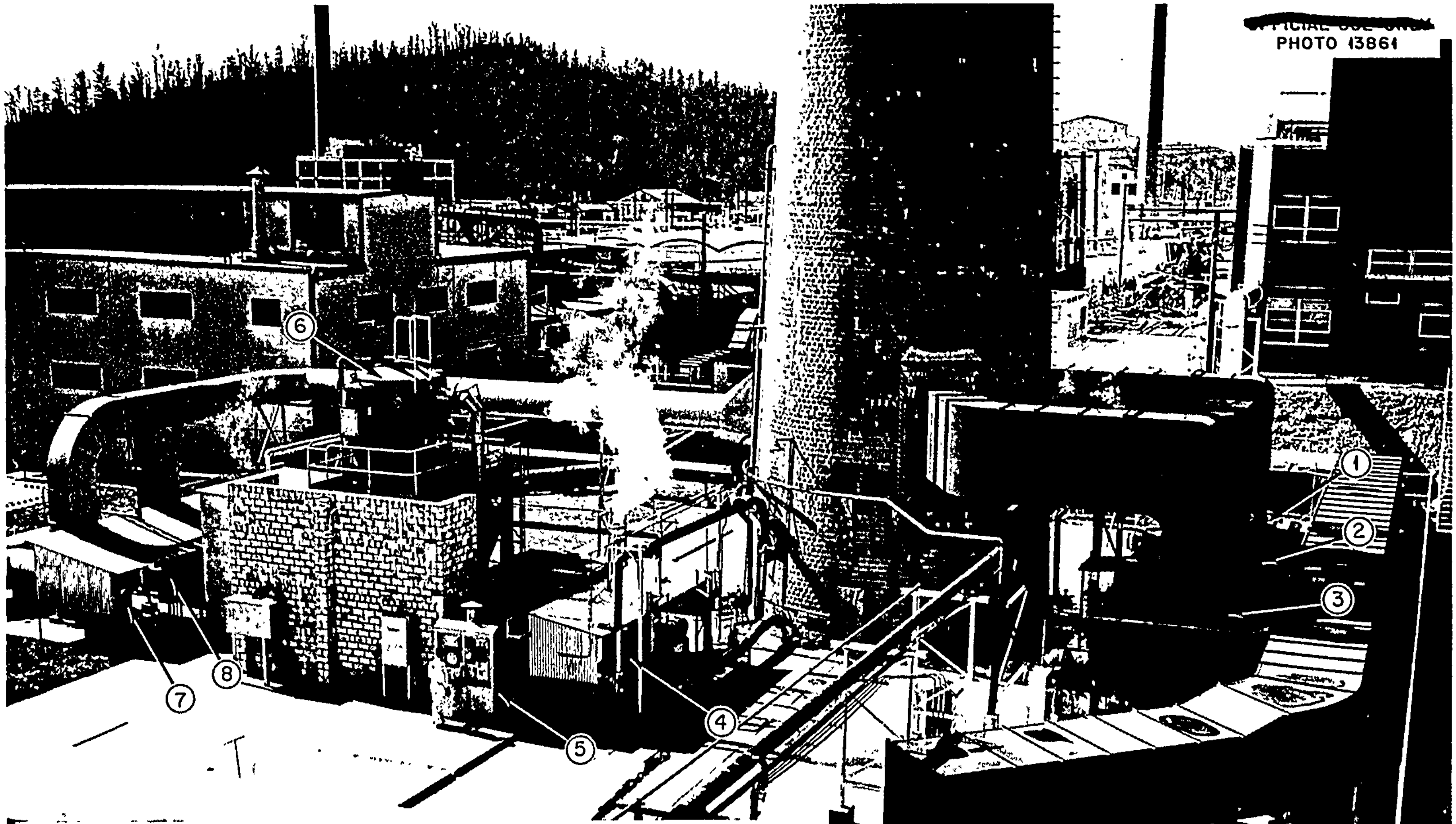


Fig. 1. Oak Ridge National Laboratory Waste Disposal System Flowsheet.



(1) 60,000-cfm CELL VENTILATION FAN FOR CHEMICAL SEPARATIONS AND PHYSICS OF SOLIDS BUILDINGS
(2) 60,000-cfm EMERGENCY STEAM-DRIVEN CELL VENTILATION FAN
(3) 40,000-cfm CELL VENTILATION FAN FOR RADIOISOTOPE AREA
(4) TWO 2,000-cfm STAINLESS STEEL VESSEL OFF-GAS BLOWERS (ONE STEAM DRIVEN, USED FOR EMERGENCY ONLY)
(5) VESSEL OFF-GAS CONTROLS
(6) COTTRELL PRECIPITATOR FOR VESSEL OFF-GAS
(7) 30,000-cfm CELL VENTILATION FAN FOR 4500 AREA
(8) 30,000-cfm STEAM-DRIVEN CELL VENTILATION FAN FOR 4500 AREA

Fig. 2. Radioactive Gas Waste Disposal Area, Facing West.

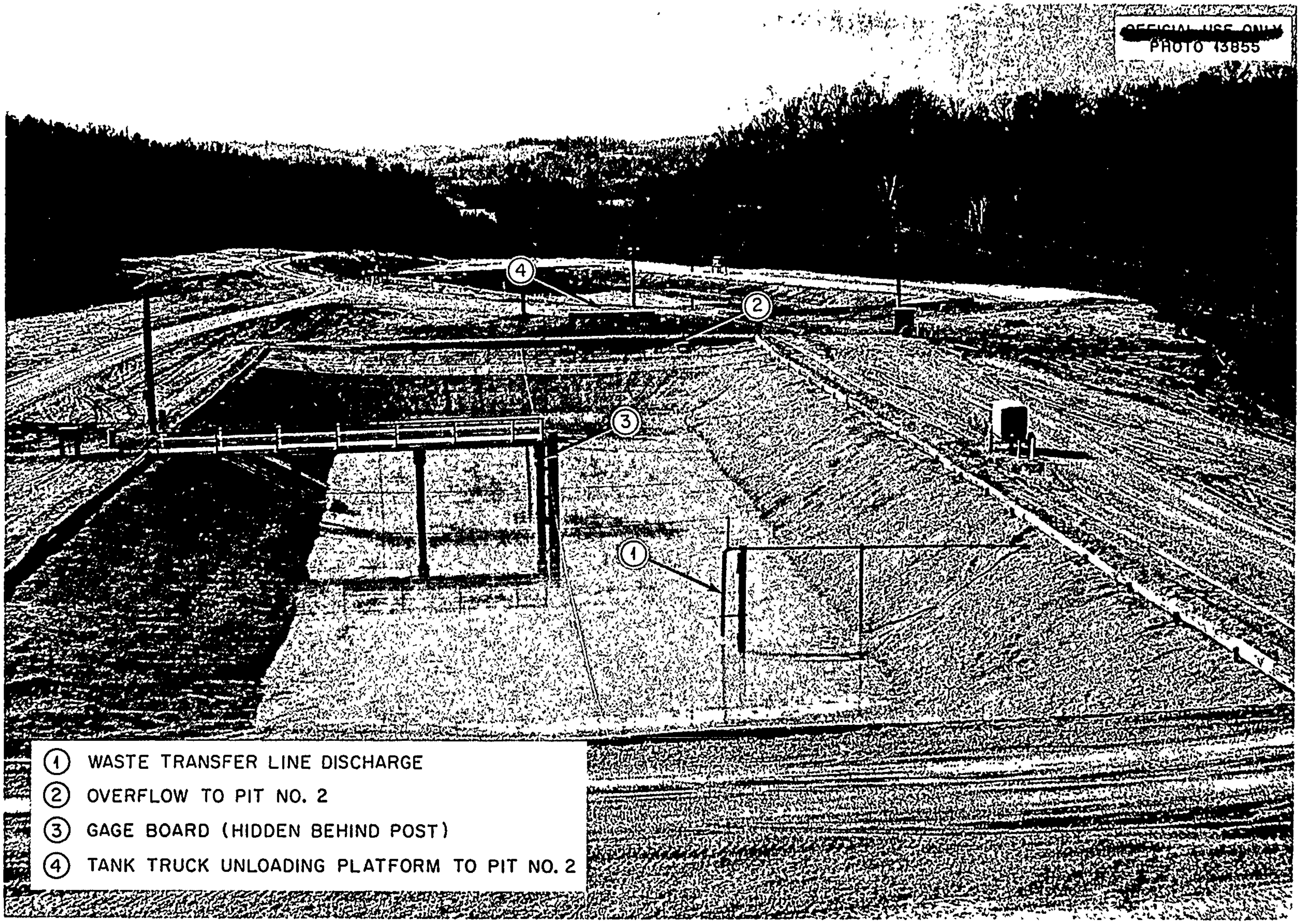


Fig. 3. Waste Disposal Pits Nos. 1 and 2, Facing West (No. 1 in Foreground, No. 2 in Background).

Waste Volume

The volume of waste was the lowest handled in any year (see Table 1). One of the main reasons for the decrease was that the Hot Pilot Plant, normally a large contributor, was shut down for alterations during a large portion of the year. The volume was also substantially decreased by diverting to the storm sewers nonradioactive waste sources unnecessarily connected to this system. It is estimated that between 20 and 35 million gal per year was eliminated by one major change alone which diverted the flow from four buildings, Metallurgy Laboratory Building 2000, Health Physics Laboratory Building 2001, Welding Laboratory Building 2005, and Health Physics Calibration Control Laboratory Building 2007.

Process Waste Treatment Plant

Efforts to reduce the volume of waste discharged to this system were made in order to reduce the load on the future Process Waste Treatment Plant, the design and construction of which are awaiting the approval of the AEC. The new plant is expected to eliminate most of the activity normally discharged to White Oak Creek (and subsequently the Clinch River) by separating and processing only the peak activity portions of total waste collected by the system; it has been noted in the past that most of the activity is collected over relatively short periods of time from accidental spills and failure of equipment. The removal of the activity would be extremely important in the event of a major spill, which, although it has never occurred, could seriously contaminate the Clinch River.

Equipment Change

The only change made in the Process Waste System worthy of note was the installation of a monitor on the lines servicing the 4500 Area. It is now possible to check the volume and activity of all major contributors to the system.

RADIOACTIVE GASEOUS WASTE DISPOSAL

Maintenance

An unusual number of bearing failures were experienced this year in the operation of the cell and hood ventilation fans and off-gas blowers. Potentially, the only serious one was in the emergency steam-driven turbine off-gas blower which was being repaired when a 2-hr power failure shut

TABLE 1. RADIOACTIVE LIQUID WASTE DISPOSAL DATA

(All volumes in 1000-gal units, activity in beta curies)

	Year				
	1950	1951	1952	1953	1954
Hot Chemical Waste System					
Volume received	2,229	2,294[a]	2,192	2,287	1,669[b]
Volume evaporated (gal processed minus gal concentrate)	2,224	2,212	2,102	2,042	711
Volume transferred to waste pit[c]	0	123[a]	43	227	997[b]
Activity transferred to waste pit[c]	0	390	953	7,716	7,224
Process Waste System					
Total volume discharged to White Oak Creek	226,350	297,590	268,180	239,356	164,290
Activity discharged from retention pond	15	3	87	140	17
Activity discharged from settling basin	172	169	411	289	237
Total activity discharged to White Oak Creek	187	172	498	429	254

[a]Includes 94,000 gal of metal waste supernatant transferred directly by truck from metal waste tanks to waste pit.

[b]Includes 87,000 gal of concentrated nonradioactive chemical wastes hauled by truck directly from operating buildings to waste pit.

[c]Waste pit No. 1 was used in year 1951 only; pit No. 2 was used for all wastes transferred in the last three years.

down the main electrically driven blower. Fortunately, the air was not contaminated because the power outage occurred early Monday morning before the operation of main chemical processes which contribute hot gases to the system was begun.

The only equipment that required major maintenance work was the electrically driven off-gas blower. In addition to repeated bearing failures, the impeller became loose on two occasions. To eliminate the repeated breakdowns, it was necessary to balance the impeller and to install larger pillow blocks for the bearings and a new Alemite oil-mist lubrication system. By the end of the year the off-gas blower had completed more than six months of trouble-free operation.

Flow Measurements

Hastings hot-wire anemometers were installed in the main tributaries of the off-gas system. It is now possible to determine the volume of gases contributed by the various users and to locate areas where the use may be excessive.

Capacity of System

The capacity of the cell and hood ventilation fans and off-gas blowers remained adequate throughout the year, although the off-gas service to the Metal Recovery Building 3505 and the Radioisotope Waste Processing Laboratory Building 3515 was not satisfactory because of a poor piping arrangement. This condition will be alleviated when a new off-gas line is laid in the vicinity of these two buildings for the future Fission Product Pilot Plant.

The fan and blower capacity, although adequate to handle present loads, may have to be expanded to take care of demands that will be created with the construction of the Fission Product Pilot Plant and the Research Reactor and the expansion of other Laboratory programs. An engineering survey is now being made for determining future requirements and the changes and additions that may have to be made to the existing equipment.